

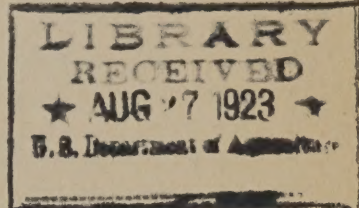
COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS

U. S. Department of Agriculture  
and State Agricultural Colleges  
Cooperating.

Extension Service, Office of  
Cooperative Extension Work,  
Washington, D. C.

DRAINAGE

Excerpts from 1922 Annual Reports  
of State and County  
Extension Agents.



This circular is one of a series issued  
by the Office of Cooperative Extension  
Work as a part of its informational ser-  
vice to State and county extension work-  
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California

In many respects the principal accomplishments of the extension service and farm bureau during the past year have been drainage activities. As a result of a small drainage test plot located at the county farm last year through the efforts of the extension service and other cooperative agencies three drainage districts embracing some 10,400 acres have been outlined and are in process of organization. The Downey drainage district embracing 4,000 acres has been surveyed, costs computed, and petitions prepared for circulation. The drainage district in the west end of the San Fernando Valley embracing 6,000 acres has been outlined, a drainage association organized, and legal papers prepared. Reconnaissance surveys have been made and test borings have been started. A small drainage district of 400 acres in the East Whittier section has been outlined and will soon be in process

\*No attempt is made to cite all reference to drainage in this circular.

Only selected extracts showing typical methods employed and results secured in a large number of States are included.



of organization. A great deal of time and effort has been devoted to drainage projects during the past year and it is felt that the results secured to date have warranted the large expenditure of time on the part of the extension service. - R. W. Hodgson, County Agent, Los Angeles, Los Angeles County.

Early in the year 1922, it became evident that the cost of tile was one of the drawbacks to more drainage work. The farm advisor, in conjunction with the board of directors of the county farm bureau, persuaded Mr. Lenz, a farmer and concrete contractor, to put in a tile making plant. He has agreed to sell tile at a price equal to other manufacturers at their yards. This saves the Napa County farmers all the freight. He has also agreed to sell to retailers at the same figure which he has for individual farmers. This year 10 tile drainage systems were established for use on demonstrations of methods and results. Three plots are near Napa, one near Yountsville, one near Oakville, one in Pope Valley, two in Calistoga, and one in St. Helena. The plot in St. Helena is on the old alluvial type of soil; all the others are on the recent alluvial type. These plots are all in prune orchards with the exception of one which is in corn. Aside from these plots 20 other farmers have had assistance in planning their drainage work. In the interest of drainage the farm advisor has made 52 farm calls and has discussed the project at all of the farm centers. One field demonstration was held. In order to secure drainage for a group of farmers west of the railroads near Yountsville, it was necessary to persuade two railroads to put in additional culverts. To prove this fact, surveys were made and the profile plotted. Representatives of the companies were taken to the region and the culverts have now been put in according to the recommendation of the farm advisor's office. - Enoch Torpen, County Agent, Napa, Napa County.

### Connecticut

Dynamite has proved to be our best drainage assistant. Ditches to the extent of about a mile in length have been blown in demonstrations to show the use and efficiency of dynamite. These demonstrations have resulted in considerable additional blastings of which we have no authentic record. In connection with this ditch blasting there have been six stump and stone blasting demonstrations, which have had considerable influence in spreading the effective use of dynamite. - F. W. Knipe, Specialist in Farm and Home Engineering, Connecticut Agricultural College, Storrs.

### Kentucky

The cost of tile drainage in Kentucky this year averaged about \$35 per acre. A total of 16 demonstrations was established. Each farmer cooperating with us in these demonstrations was furnished with a map of the field drained, showing the location of all tile lines, a profile map showing the proper grade for all lines, and the proper cut at each 50-foot station in addition to a bill of material, and estimate of the cost of installing the entire system. The cooperating parties furnish us, when the system is completed, with a detailed cost of doing the work. They also keep records of the yield secured from this drained land. Wherever drainage systems have been completed, it has led other farmers in the same community to take up drainage as a method of increasing yields on wet land. - J. B. Kelley, Specialist in Agricultural Engineering, College of Agriculture, University of Kentucky, Lexington.



The drainage specialist at the college drew up plans for the field tiling after a contour map had been made. The tiling was put in according to the directions of the specialist. A complete cost account was kept from beginning to end and it was found that the entire cost of installation was \$32.02 per acre. Just across the ditch from the piece of land which was tiled was a piece of land which was not tiled and comparative figures were kept on the tiled and untiled land. The whole field, tiled and untiled, was put to cow peas after the work was completed. The tiled land had a far better growth of peas than the untiled. The peas on the tiled land were higher than a man's waist; while those on the untiled land were a little over knee high. This crop was cut for hay and baled and weights kept to show the difference. The tiled land produced 5,350 pounds per acre while the untiled land produced 3,753 pounds per acre. This crop of hay sold for \$30.00 per ton. The first year the tiled part of the land lacked only \$8.14 per acre of paying for itself. The work has been entirely successful and the people are well pleased with the results. In fact they are so well pleased that at the present time plans are under way whereby they hope to do more tiling this year. This demonstration was watched with a great deal of interest because many people knew the history of the field and knew how it had been producing. This year is the first year that a profitable crop has been grown on this field for some time. Ordinarily this field was the last one to be broken in the spring because of the water and low wet places. This year it was the first to be broken. A tractor was used and no wet places were encountered at all. - W. H. Rochester, County Agent, Greenville, Muhlenberg County.

## Maine

Largely because of such good results obtained by ditching demonstrations during the past two years, five men asked for this work. Four of them arranged for it at the planning meetings. The other was directed to the county agent by the local atlas dealer. This last case became the entering wedge into a new community. Local arrangements were handled entirely by the demonstrator and project leader, who also handled the advertising. This type of demonstration seldom fails to turn out a good crowd; once in a while a few of them help. The local atlas dealer delivered the material for the two largest jobs. The following table gives the data for the demonstrations:

Community	Demonstrator	Length of ditch	Cost per yard	Attendance
		Yards		
West Auburn .....	J. E. Flanders	550	\$0.25	30
Lisbon .....	L. M. Ross	50	\$0.32	8
Mechanic Falls .....	S. H. Hemphill	100	\$0.29	30
Richmond Corner .....	B. R. Temple	400	\$0.31	40
Sabattus .....	J. Atwood	75	\$0.12	30
Total .....	5	1175	\$0.26	138
Average cost per yard .....				\$0.26

R. N. Atherton, County Agent, Auburn, Androscoggin and Sagadahoc Counties.



## Maryland

One successful demonstration in this county was the opening up of a slave dug ditch on the farm of Dr. J. Collison with the use of dynamite. This ditch was one and one-half miles long and 500 pounds of dynamite were used. The ditch had a mean depth of seven feet and drains possibly 600 acres of land, and takes off surface water from another 1,000 acres. Results have been widespread and several other farms have undertaken to drain similar plots of ground. Another demonstration in tile drainage was conducted on the farm of Frank Duckett, Davidsonville. The farm engineer visited the farm and laid out the drains, and made estimates of the amount of tile. Duckett ordered the tile, dug the ditch, and laid the tile so as to be ready by planting time. Results of this demonstration were miraculous. The land was drained almost immediately and corn of good quality was grown here last year. Sedge bunch grew in the course of digging ditches. An old two-inch tile was dug up and it was found that this tile was laid in 1842; most of it hand-made tile. Many of the tiles were still running a good stream of water and these were connected with the system just laid. On investigating springy places in the field later on it was found they were caused by clogged up old tile drainage. These of course were rectified and the result has been most gratifying.- G. W. Norris, County Agent, Annapolis, Anne Arundel County.

## Michigan

Drainage extension work has consisted of making drainage surveys and providing plans for drainage systems. A drainage campaign was put on in Sanilac County according to the plan submitted last year and has proved quite successful. A series of meetings were held during February and March to bring before the people the value of drainage. As a result, 22 farmers asked to have drainage plots of various sizes ranging from 7 to 35 acres put in on their farms, and 68 farmers asked to have their farms surveyed for future drainage systems. Five demonstration meetings have been held in the fields which were attended by about 240 people. Publicity articles were run in the county papers regarding the work. Surveys have been made on 28 farms comprising 2240 acres, and visits made to 25 other farms where suggestions have been made. Nine demonstration plots comprising 147 acres were drained. These plots required 6,000 rods of ditch and practically 20 carloads of tile. The work was delayed owing to our inability to secure the services of a tiling machine when desired, also the coal shortage delayed delivery of tile. Much more work could have been done as there were several other applicants. - O. E. Robey, Drainage Specialist, Michigan Agricultural College, East Lansing.

Three drainage projects have been worked out using the open ditch dug with dynamite. One demonstration lasted five days and was seen by approximately one-third of the people in the county. A ditch one mile long, four feet deep, and seven feet wide was dug with dynamite for less than half of the cost of other methods of ditching in swamps. This gave a spur to the ditching in the county and in two months that have expired since, nine ditches have been dug by the same method. - W. E. McCarthy, County Agent, West Branch, Ogemaw County.

During the year 24.6 days have been devoted to the soil improvement project. The major portion of this time has been in the interests of the tile



drainage project, which has occupied the major portion of our soil improvement program. Three drainage systems were planned and the tile laid on a total of 96 acres. In addition to this, portions of two other demonstrations planned a year ago, have been completed, making a total of 150 acres tile drained in the county during the summer. On August 31, a drainage tour was conducted over the county, visiting some of the drainage systems previously installed, where the farmers had an opportunity of seeing the results obtained. In addition to this, one project in the process of construction was visited, where those present had an opportunity of witnessing the laying out of a system, the digging of trenches with a traction ditcher, the laying of tile, and the back filling of trenches. On the farm of H. J. Vogt and Son, the tourists saw a 19-acre field of corn growing on a tile-drained field, which had grown nothing but buckwheat for the past 33 years. Mr. Vogt stated that previous to tile draining, he had lost one crop of buckwheat out of every three. One 12 x 30 and one 8 x 30 silos were filled from this field with 6 acres of corn remaining. Mr. Vogt further stated that he had gotten as much from this field this year as he had during the past 33 years.

Mr. Charles Babcock, on whose farm a system has just been completed, says, "From the way those tile are taking water out of those fields, I feel confident that I will now be able to grow crops that will pay for the cost of draining in two years time. I feel that I have simply bought another farm beneath the one I have been working and that I purchased the farm at one quarter of what it would have cost any where else." Mr. P. M. Stein in commenting on his project says, "From that portion of the system installed early in the spring, I have seen sufficient results that have convinced me of the necessity of the tile draining the remainder of my farm next year. I feel certain that any one under similar conditions can afford to hire the money to tile his farm." Tile drainage is the first prerequisite in soil improvement on at least 60 per cent of St. Clair County soils. Consequently work along soil improvement will proceed slowly until more tile draining is done. One drawback in this work at the present time is the fact that the price of tile has not come down on a parity with that of various farm crops. - C. M. Kidman, County Agent, Port Huron, St. Clair County.

As mentioned before, drainage was our big project for the year. As Sanilac County is the largest county in the Lower Peninsula, containing 26 townships with an acreage of 624,000, and as this county has a large number of dredge ditches and very little tile work, it is very important to carry this special information to all the farmers that they might know proper methods of tile drainage. O. E. Robey, drainage expert of the extension department, directed the work. Previous to the drainage campaign, visits were made to all bankers, many of the business men, county papers, and high schools to interest them in helping in the program. On February 27 we held our first meeting and this was followed by 19 others in different parts of the county. During these meetings we had an attendance of 1100, secured 24 drainage demonstration plots, amounting to about 200 acres of land, also secured 68 farms for preliminary survey comprising about 7,000 acres.

Arrangements were then made with the drainage contractor to do the work which started about the first week in May. During the months of May and June, 7,000 tile were laid draining 12 acres of land on the Wm. Roskey farm at Applegate. Next, 12,000 tile were laid in the Miller farm, draining 20 acres.



Here a public demonstration was held. Prof. Cox and Robey attended this demonstration and gave instructions on drainage and the raising of crops. Later, 14,000 tile were laid, draining 22 acres on the George Weyenth farm at Deckerville. Another public demonstration was held, with Robey attending in conjunction with four Canadian county agents, County Agent McVittie, and Assistant County Agent Leader Ballard. The machine then moved to Charles Wolf's farm laying about 5,000 tile and draining 8 acres. Difficulty was then encountered by not having the contractor continue in the work. Hibler, of Akron, was engaged to go ahead with the program. On September 15, work was started on the Miller farm, laying about 9,000 tile and draining 15 acres more. Here another demonstration was held, but poorly attended. The machine then moved to Thos. Cumming's farm, where 8,000 tile were laid draining about 12 acres more, and later to M. W. Frey's farm, laying 14,000 tile and draining 22 acres. It was necessary at this time to make arrangements to obtain another contractor. Mr. Hull agreed to complete the work. The machine then moved to Lewis Merriman's farm, about the middle of October, laying 6,000 tile and draining 11 acres; then to Scott's farm laying 4,000 tile and draining 6-1/2 acres; then to Sample's farm laying 5,000 tile and draining 6-1/2 acres; then to Michael's farm laying 8,000 tile and draining 9 acres. In all, 160 acres of land were drained and this is to be used for demonstration purposes to prove to the farmers that tile drainage pays. It required 61.5 days to carry through the above program. - J. D. Martin, County Agent, Sandusky, Sanilac County.

#### Nebraska.

A preliminary survey was made by the agricultural engineer, Ivan D. Wood, followed by the making of a complete survey and blue prints. Much of the ditching has been completed with gratifying results. Some of this overflowed land was planted to corn returning a yield of 60 bushel to the acre, where none had been grown before. Following is the report from Mr. Wood:

Historical - Medicine Creek is tributary to Republican River and winds across Frontier county. In old days the bed of creek was deep and fairly straight. Farming has brought in much sediment from the hills and each year the creek becomes more crooked, until flood water now ruins the crops on the bottom nearly every year. Crops on this bottom in 1921 were a total loss.

Description of area - The area comprised in this project is four miles long and from one-fourth to one-half of a mile wide. The land when not overflowed is very fertile, and is the most productive land in the county. Approximately 1,000 acres will be reclaimed when the project is completed.

Method of drainage - Through the farm bureau, the extension engineer made a survey of the area. Each land owner was interviewed and the line of ditch was staked out. Expensive dredge machinery was not used. The dredge ditch cost \$3.12 per rod. The farmers made their own ditch at less than \$1.00 per rod. The new ditch cuts off the bends in the old creek, reduces the length of stream, and reclaims 1,000 acres. - W. H. Campbell, County Agent, Stockville, Frontier County.

#### Nevada

A drainage ditch was dug near Preston Creamery (White Pine County) which reclaimed from a tule swamp, badly alkaliied, about one acre of ground,



which was leveled, seeded to crop and produced well this year. A thousand acres on the Cleveland Ranch, in Spring Valley, was a swamp producing about 200 tons of wild hay to the thousand acres. One open drain, over a mile in length, was built, as well as intercepting drains to carry the water, from the springs at the source, away from the land. This drainage resulted in an increase in the past year of 1,000 tons of hay. Four hundred acres on the lower Hot Creek Ranch at Sunny Side were drained and alfalfa will be planted on most of this acreage in 1923. Twenty-five acres on the Three "C" Ranch in Steptoe Valley, on which oats was growing, was drained in order for the oats to ripen and produce a good crop this year. - Robert G. Foster, Assistant Director, College of Agriculture, University of Nevada, Reno.

#### New York

One piece of work by the farm bureau, which is commanding considerable attention, is that of making open ditches by the use of dynamite. Demonstrations in muck areas and others have been held showing the practicability and low cost of the work. One ditch across a field 12 rods wide was made 2 feet deep and 5 feet across, at a cost of 63 cents per rod. Those who saw this piece of work were unanimous that such an open ditch could not be made in any other way at such a low cost per rod. The results of this piece of work are that over 3,000 feet of ditching, through this unproductive area, will be made which will bring the land into productivity. An open ditch was made in clay, 3 feet deep and 6 feet wide, at a cost of explosives of 98 cents per rod. The result of this demonstration is the opening up of approximately 50 rods of an old ditch which will bring what is swamp land at present into productive hay land. - H. B. Little, County Agent, Saratoga Springs, Saratoga County.

#### North Carolina

During the past 12 months, 44 farms situated in 22 counties have been visited for the purpose of giving assistance and advice in tile drainage. The area of these tracts covered by surveys, and for which plans and reports for tile drainage were proposed, covered a total of 1,016 acres on 16 farms. This does not include areas examined, of which no survey was made or map prepared. States and grades for tile drainage construction have been given on 13 farms in 9 counties for the installation of 88,265 feet of tile, approximately 17 miles. Twenty-two thousand feet of open ditch were staked out, and grades and cuts given for constructions. - F. O. Bartel, Drainage Specialist, North Carolina State College of Agriculture and Engineering, Raleigh.

#### Ohio

The drainage problem is one that always needs emphasizing in this section. During the year 1922, we have, with the help of the extension service, undertaken some project work in drainage. The object of this work has been to sell the idea of a drainage system. Three parties are directly interested. These are known as cooperators; viz., the owner, the extension service of the University, and the local committee. The owner agrees to follow out the plans as mapped out by the extension specialist. The county extension agent agrees to assist in the laying out of this plan; the local committee agrees to adver-



tise any and all demonstration meetings, and be more or less responsible for their success. The county farm bureau furnishes a sign large enough to show the plan of the system and the cooperating parties. The owner agrees to place the sign where it will be seen by those who happen to pass. This year nine such systems have been mapped. The majority of them are at the present time posted and some are under construction. - E. C. Sleeth, County Agent, Jefferson, Ashtabula County.

#### Oklahoma

The calls for drainage seem to be on the increase. During the past year, 15 demonstrations and 8 surveys have been made. The average farmer in Oklahoma, who has hillside seeps or flat wet land, does not have the means to do much tile drainage at present, so if there is any way to help the land other than by tile draining, it is demonstrated to them. The hillside seep is a drainage problem that is difficult to overcome unless tile is used. In the case of several hillside seeps, farmers have been advised to put in tile. Lines are run and grade stakes set for them. Only a few farmers have put in tile at present but most of them are contemplating putting it in as soon as they are able. The greater number of calls for drainage are for the draining of flat, wet land, sloughs, and boggy lakes. In most of these cases, open ditch drainage has been advised for the present or until they are able to put in tile. This will make the land produce well, but the ditch is unsightly and inconvenient. At these demonstrations profile leveling has to be taken up which is rather difficult for the average farmer to understand but he does get the idea even if he cannot do it himself. Special effort is made to teach it to the county agent during, and after, the demonstration so that he can handle similar problems in his county. It is not so easily taken hold of as terracing.

#### Procedure at a drainage demonstration:

- (1) Walk over the field with the men, taking a spade and post-hole digger to examine the soil for several feet deep. After the nature of the sub-soil is determined, discuss the advisable course to follow.
- (2) The next thing is to see if it is possible to locate the tile line or ditch without making a contour map which is generally the case on small projects.
- (3) After the location of the lines is determined, run the line and drive grade stakes, then take the level readings, after which compute the grade and grade lines and determine the depth of the ditch at various places explaining all this to the men. Afterward go over it with the county agent in more detail. He needs it in his ditch work in terracing as well as in drainage. - W. H. McPheeters, Farm Engineering Specialist, Oklahoma Agricultural and Mechanical College, Stillwater.

A large valley of fertile gumbo soil lies along Deep Fork Creek across this county from north-west to south-east. Many of the level farms in this



valley have not ample drainage, notwithstanding the fact that a great drainage ditch has been cut along the valley the full width of the county. Lateral ditches have been proved impractical for many of these level farms, but until this year tile drainage had not been tried out on these farms. Early last fall, Mr. P. F. Sennett of Chandler, who owns one of these Deep Fork bottom farms, asked the county agent to visit his farm and see what could be done to drain it properly. The county agent found a lake, varying in depth from one foot to four feet, covering about six acres of this farm, and the low, wet lands bordering either side of the lake covered at least 50 acres, thus making about one-third of his quarter sections of land unavailable for agricultural purposes. The county agent took his field level and surveyed the fields to ascertain the possibility of tile drainage. He found that with the use of 1800 to 2400 feet of such drainage would possibly make this entire 60 acres available for cultivation. An open ditch was surveyed and cut through an elevated ridge of 400 feet, giving partial drainage to the lake, and permitting the dry weather, during the fall and early winter, to completely dry up the water from the lake. Mr. McPheeters, the extension engineer, was called for a final survey of the field for properly locating the lines for tile. He suggested that approximately 500 feet of 6-inch tile and approximately 1900 feet of four-inch tile be used in the project. An order was placed immediately for the required amount of tile, and the ditch for the tile was cut. The ditch varying in depth from six feet to zero. The tile was laid and the job completed at a total of \$325.00. With all of the excessive rains of the spring, splendid crops have been grown this year right up to the old lake bed, and a part of the lake grew a good crop. Thus it was that we demonstrated the practicability of tile drainage for hundreds of the level bottom land farms of that creek bottom, and it is expected that such a system of drainage will be begun on many of these farms in the near future. - J. W. Guin, County Agent, Chandler, Lincoln County.

### Oregon

The records of this office indicate that 37 individual farm drainage systems were laid out, comprising 831 acres. Nine community drainage propositions were launched involving community cooperation and comprising 6,425 acres, and nine drainage districts comprising 13,030 acres were given assistance. Twenty individual irrigation systems were designed, comprising a total of 330 acres. The table summarizing the irrigation district work indicates three districts, comprising 55,840 acres. While assistance has been rendered by the county agents of the various counties, the initiative in organizing these districts was not taken by the extension service.

The method of demonstrating has also been slightly modified. Heretofore the field demonstrations consisted largely in running ditch levels, but during the past year it has been the practice to stress the matter of laying out the entire drainage system for the farm. In addition the farmer has been given assistance in running his levels. He is in a position, therefore, to proceed as rapidly as his time and funds may permit, to complete the entire farm drainage system. While heretofore the results have been reported under the heading of individual drainage systems, and irrigation districts, Mr. Kable reports that under certain conditions it seems more feasible and desirable to organize communities for voluntary coopera-



tion in the matter of constructing outlet ditches, rather than to go through the more formal process of organizing under the drainage district laws. It will be readily understood that the entire farm is not always drained immediately after the system is laid out. Neither does the community, organized for voluntary cooperation, always proceed to complete the contemplated project. Many times after all the preliminary work has been done towards the organization of a district, the proposition is voted down and remains dormant until there is a revival of interest. A district may go a step further and complete organization and then fail to do construction work. - P. V. Maris, Director of Extension Service, Oregon Agricultural College, Corvallis.

Only one community or district has had drainage troubles, but between 600 and 700 acres of good land in the Ochoco District have either become too wet to farm or are showing evidence of fast reaching that point. Only one demonstration has been made on this work, that being on E. N. Hall's place where 50 acres have been lost during the past year. Alkali was showing up and the land was too boggy to farm. The agent secured the sluicing machine developed by the experiment station and a demonstration was held on October 6. A ditch three-fourths of a mile was made, and in three weeks time a team could be driven up to the ditch. The irrigation district is building a similar machine and are placing it at the disposal of any farmer needing it. - W. B. Tucker, County Agent, Prineville, Crook County.

The drainage project was given very little attention by the agent during the year. However, some progress was made in canal construction by the sluicing method as reported in 1921. The Southeast drainage district continued some construction work; Percy Purvis, of Vale, and his neighbors, constructed about two miles of canal; and three men of Vale community built one-half mile of canal 12 feet in depth, at a total cost of \$230.00, most of which was for their own labor and teams. As a result of publicity given this work, the sluicing method of canal construction is being tried in a number of places in Oregon and other States. - L. R. Breithaupt, County Agent, Ontario, Malheur County.

### Pennsylvania

An examination of the soil surveys of the State shows that something over 4,000,000 acres or about one-seventh of the State needs some form of artificial drainage. Much of this requires field drains where open ditches would largely prevent the use of modern farm equipment. Tile drains offer the best solution of the problem. The majority of the tile drains laid last year are proving unsatisfactory, usually through some fault in construction. In order to demonstrate permanent tile drainage construction, eight systems were staked out and built in five counties. In 10 other counties 11 projects were constructed, making a total of 19. These required the use of 17 carloads of drain tile and four tons of dynamite, the latter having been used in opening several outlet ditches. A good corn crop was grown on one of the earlier projects which cost about \$25 per acre to install. The owner estimates that the improvement increased the value of his land at least \$100 per acre. Much preliminary work was done which will be of use when the material and labor markets return to normal. - M. S. McDowell, Director of Extension Service, Pennsylvania State College, State College.



### South Dakota

One hundred and thirty preliminary surveys have been made in 23 counties and a consulting engineer's recommendation made on each, including a cost estimate. Twelve demonstration farm tile-drainage projects have been completed under our direction and will serve as demonstrations to their community for years to come. Eleven field meetings were held on the tile-drainage projects. Fourteen inside meetings were held with drainage as a subject. Most of them were illustrated with slides of South Dakota projects. Thirty publicity sign boards were installed at former tile-drainage demonstration projects, over the State, during the period covered by this report. Only one of the above projects (this year) has had a sign board installed on it as yet. Publicity has been given to drainage in general and to the above projects in particular throughout the year, but not as much as should have been, especially that about the finished projects. A complete set of slides were made up of pictures of South Dakota drainage projects that have been completed as demonstrations during past years. - R. L. Patty, Specialist in Agricultural Engineering, South Dakota State College of Agriculture and Mechanic Arts, Brookings.

### Texas

Drainage ditches have also been surveyed on two bottom land farms. Good crops of both cane and cotton have been raised on this land this year in spite of the heavy rains in the spring. One of these farms has been in cultivation for more than 50 years; and a decreased yield of crops was common on several acres, because water stood on this part of the field for some time every year. This was on Rufus Simmon's farm near Burkeville. It is a kind of buck-shot soil. He said he had never been able to get his ditches of the right grade to handle the water without starting big gullies back in the field. Last fall when I surveyed the lines, several acres of the land were covered with marsh grass and corn stalks about a knee high. On the same soil this year he harvested 30 bushels of corn to the acre, half bale of cotton and about 400 gallons of ribbon cane syrup per acre. - J. B. Dorman, County Agent, Newton, Newton County.

### Virginia

Regardless of the almost prohibitive freight rates on drain tile, the college has received a large number of requests for assistance and advice on drainage. While the large amount of work done on other projects has necessarily restricted the number of drainage demonstrations, at the same time very satisfactory progress has been made with this project. During the year, 114 farmers were given personal assistance and advice on the drainage of 4,640 acres of land and 33 farmers were given advice through correspondence. Most of the land examined was in cultivation but due to the wet nature of the soil only a part of a crop could be raised during the average season. On 74 of these farms preliminary surveys only were necessary, as the drainage problems were simple. For a comparatively small cost per acre, the wet land on these 74 farms, consisting of 3,345 acres, could be increased in productive value at least \$10.00 per acre annually by drainage. In other words, \$33,450.00 would be annually added to the productive value of the



land through drainage. On the other 40 farms complete surveys were made and drainage maps prepared for 1,295 acres of wet land. This land needs complete drainage systems which will cost approximately \$50.00 per acre. The increased productive value will amount to at least \$20.00 per acre; or an increased productive value of \$25,900.00 annually on the 1,295 acres. One hundred and sixty-five drainage bulletins were mailed out to farmers upon request. - C. E. Seitz, Agricultural Engineer, Polytechnic Institute, Blacksburg.

### Washington

The main work, as heretofore, has been with the individual farmer who has fields that can be improved by removing the excess moisture. One hundred and thirty-four farms have been visited, plans made and lines run involving 3,808 acres. Small community projects where from three to ten or a dozen farmers can go in together, involving 33 farmers and including 1,280 acres were looked over, plans made and advice as to how to get together and do the work was given in addition to the individual work before mentioned. Two districts, looked over and helped in 1921, and involving 800 and 940 acres respectively, are now in process of construction and another involving 10,000 acres is now having the preliminary surveys made upon which to base a closer planning of the drainage work. There have been 18 drainage meetings held during the year with a total attendance of 143 persons. The subject of drainage was also touched upon in several general meetings such as Grange and community meetings. Many farmers report increase in crop yields of 100 per cent or more due to the drainage they have already put in. Others cannot report on yield until next year. - A. B. Crane, Drainage Specialist, State College of Washington, Pullman.

Drainage systems were planned for 7 farms, the total acreage of the area requiring drainage being 72 acres. The drainage of approximately one-half of this acreage was completed this fall and will be ready to crop in 1923. Ditching with powder was demonstrated on a large scale for the first time this year and attracted attendance from all over the country. A ditch, 600 feet long, 5-1/2 feet deep and 7 feet wide at the surface, was shot through heavy clay into a swamp, part of which was 1 to 3 feet deep in water, where no other means of ditching was possible, at a cost of \$42 for powder and \$4 for labor. As a result of this demonstration two more difficult ditches were shot, cost accounts being available on but one of these. In this case 800 feet of ditch, 4 feet deep, and 5-1/2 feet wide at the surface was shot through muck and muck loam at a cost of \$35 for powder and \$12 for labor. This is a very satisfactory way of excavating large difficult ditches, as it is both cheap and fast, and promises to do much in reclaiming the lands of the county that need drainage. - H. E. Drew, County Agent, Shelton, Mason County.

Drainage District No. 1, San Juan County, comprising about 800 acres of benefited area and 14 land owners, was organized during the past year. The engineering work has been completed and it is expected that bids for construction will be called for in November or December. Drainage District No. 2, San Juan County, comprising about 150 acres of benefited area and nine land owners, is in the process of organization at present. The elec-



tion will be held this month and it is believed that it will go through O.K. Five individual drainage projects involving 101 acres with 4,500 feet of open ditch were completed during the year as a result of help and advice from the extension office through A. B. Crane, Drainage Specialist and the county agent. W. W. Gallanger makes the statement that the 40 acres he drained by open ditch produced three times as much oats as it did the year before. The estimated yield previous to drainage was about 20 bushels per acre. If the crops from these 101 acres were only doubled by drainage, using oats as a standard at the present price of \$32.00 per ton, it would mean an increased income to these men of \$10.30 per acre or \$1,040.30 for the 101 acres. In July Mr. Crane gave 8 farmers assistance in laying out tile drain ditches involving 83 acres of land. No work has been done on these projects to date. - W. W. Henry, County Agent, Friday Harbor, San Juan County.

For soils west of the Cascade Mountains drainage is important in increasing their productivity. During the past year, the drainage specialist, A. B. Crane, has worked on seven projects, some of which were community problems. These projects involve 572 acres. Some of the projects have been completed or will be during the coming winter. In sending out questionnaires for the result of drainage work in this county, information was gathered from practically all of the men who have received assistance from the drainage specialist. Several of the reports did not include any financial statement of the value of the work done. Those sending in the financial value, tabulated the amount to approximately \$2,100.00.

A ditching demonstration was held at the L. R. Palmer Ranch where stumping powder was used to remove the soil from the ditch. The muck soil was underlaid by hard pan at a depth of from three and one-half to four feet. The powder was so placed that it opened up a ditch six feet wide in the top and four feet deep. This work was done at a cost for powder of \$8.25 per hundred linear feet of ditch. A small community drainage district was planned at Malthy; the work on this project has been practically completed and will be of service to the community during the wet season of 1922 and 1923. The school grounds of the Riverside School, three miles west of Granite Falls, contained a large pond, which was an annoyance to teachers and pupils. A drainage plan was laid out for this and the work was done to the satisfaction of people living in the community.

Another drainage project was laid out on a farm between Everett and Bothell, tile being laid immediately upon completion of demonstration plotting and results obtained this year. The cash value has not been turned in because the potato crop has not been marketed. The Westhold Farm, one mile south of Edmonds, had a new system planned for it. This system meant a saving to the owner as well as better drainage. - W. D. Love, County Agent, Everett, Snohomish County.

### Wisconsin

To gain a fair idea of costs and ultimate profits on the installation of the 100,000 feet of tile land laid by 37 farmers, conservative figures through several forms of calculation reveal some interesting facts.



Cost of installation (ditching, etc.).....	\$3,100.00
Cost of tile (average) .....	7,500.00
Total cost .....	10,600.00
Increased land value (estimated) in two years .....	9,000.00
Difference to be paid for in increased crop value .....	1,600.00
Crop value (in terms of silage) for two years .....	8,500.00
(Increase of crop value for first and second years made proportional to reasonable improvement through drainage.	
Net receipts after the 100,000 pieces of tile have been laid and paid for in two years time through increased land and increased crop value .....	6,900.00

After two years each farmer (other things being equal) will have paid for this system and have net cash of \$186 plus the increased value of his drained acres. While these figures are estimated even at best, and not absolutely accurate, they are reasonable in that they help to prove the statements by the majority of those who have laid tile in the past few years that the investment is a good proposition and that the engineering assistance, through the service of an agent, is profitable to the farmers of the county.-  
J. L. Wenstadt, County Agent, Plymouth, Sheboygan County.

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